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(71) Applicant
Rheinmetall Gesellschaft mit beschrankter Haftung (FR Germany),
Ulmenstrasse 125, 4000 Dusseldorf, Federal Republic of Germany

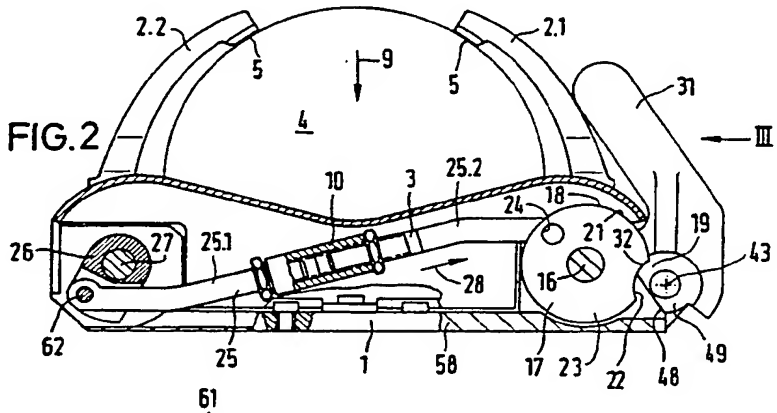
(72) Inventors
Hans-Theo Hechenbach
Henning von Seidlitz

(74) Agent and/or Address for Service
J B King,
Kings Patent Agency Limited, 146a Queen Victoria Street, London EC4V 5AT

(54) Weapon loading apparatus

(57) Loading apparatus for a barrel weapon, e.g. a tank gun, has two symmetrically opening and lockable projectile holding clamps (2.1, 2.2) interconnected by a synchronous pivoting device (3) arranged so that after the projectile has been positioned and one holding clamp (2.1) closed, the other clamp is automatically closed also, the closed position (5) of the clamps being adjustable through a screw adjusting means (10). The projectile (4) is moved into the loading chamber (12) in an axial direction (7) after the loading position (11) has been reached. A locking device (19,31) secures the clamps (2.1, 2.2) in the closed positions (5) which are maintained when the projectile (4) is subject to centrifugal force opposite to the introduction direction (9) during the transfer of the projectile (4) from an introduction possition (13) to the loading position (11).

FIG.2



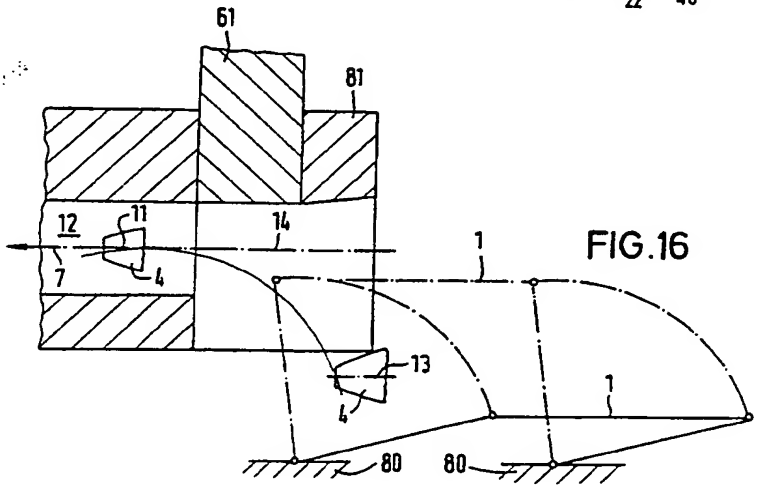


FIG.16

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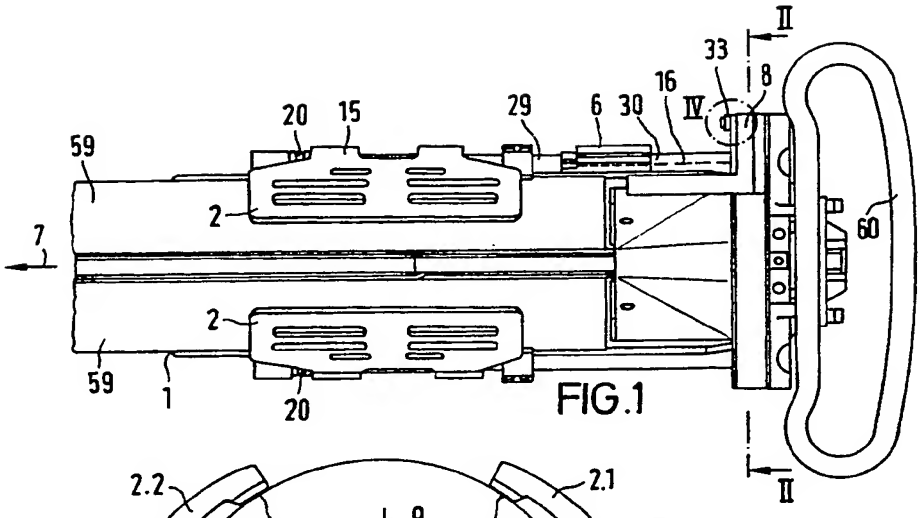

FIG.1

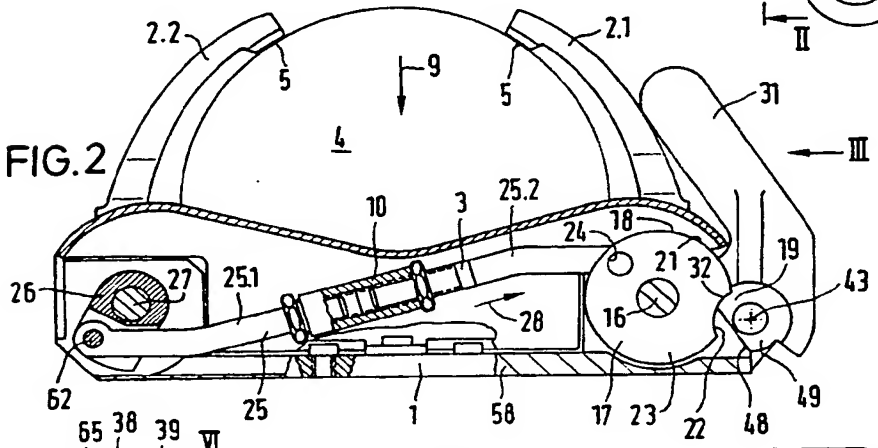

FIG.2

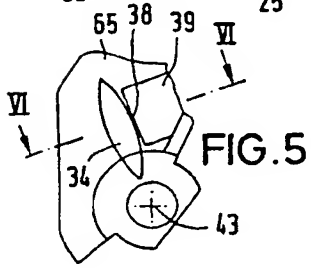

FIG.5

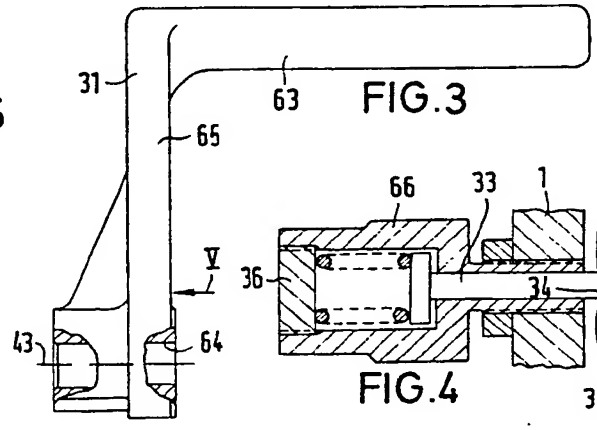

FIG.3

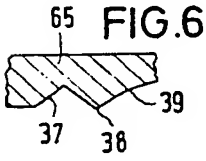

FIG.6

FIG.4

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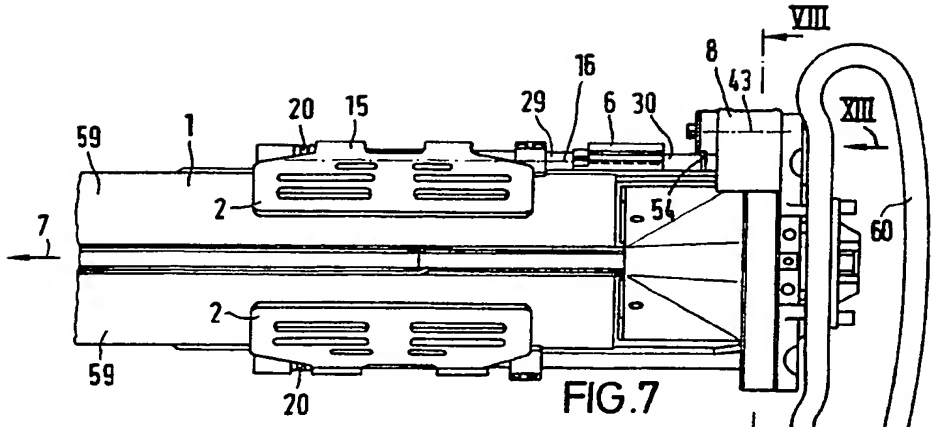

FIG.7

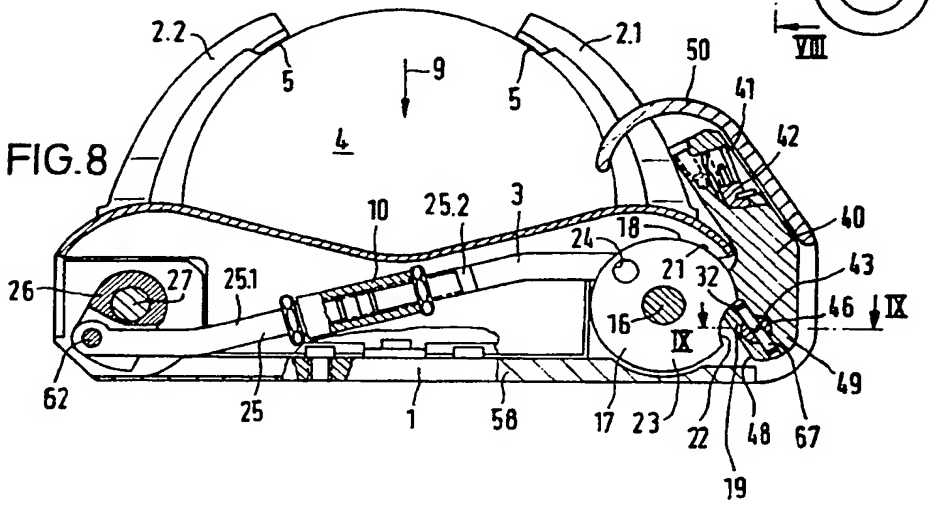

FIG.8

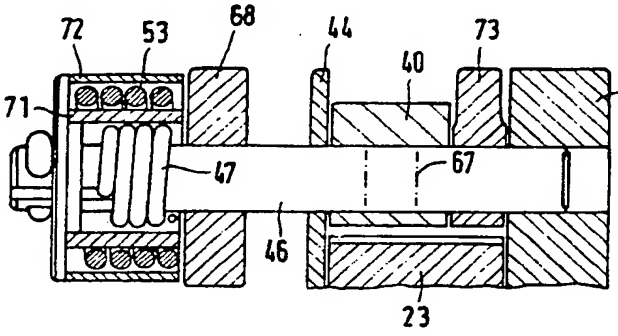

FIG.9

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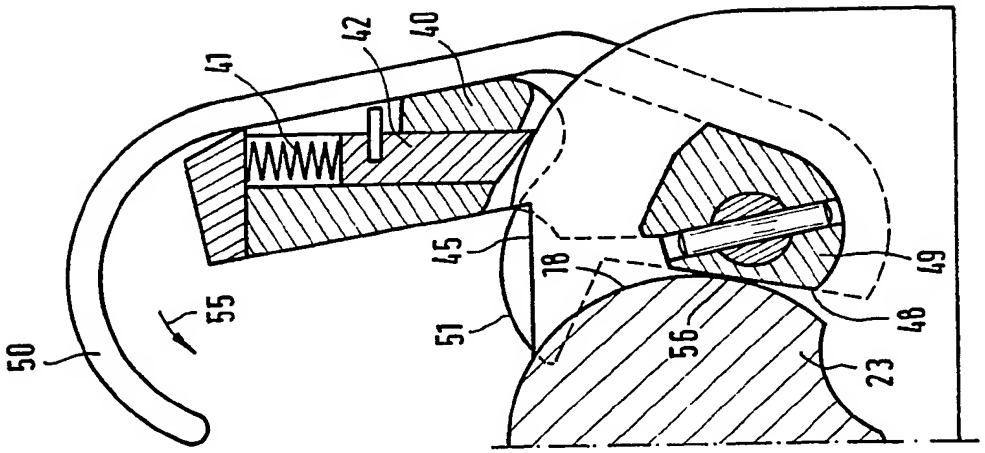

FIG.12

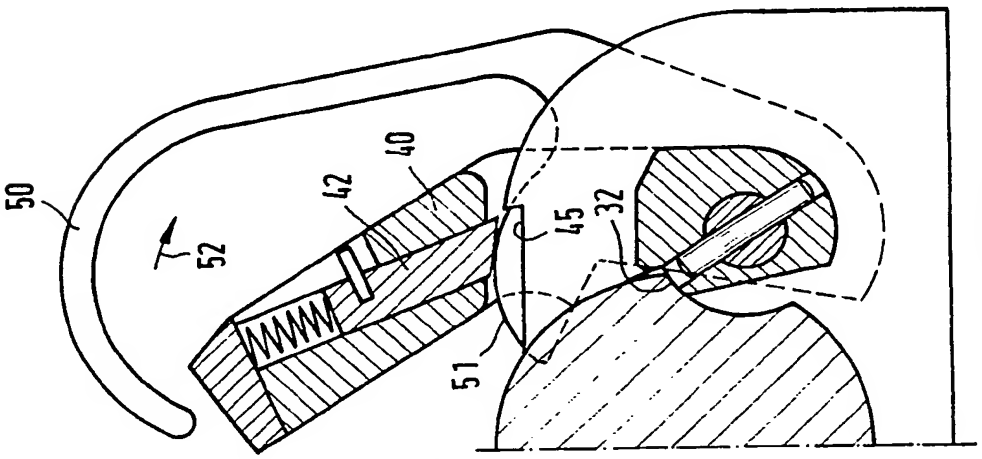

FIG.11

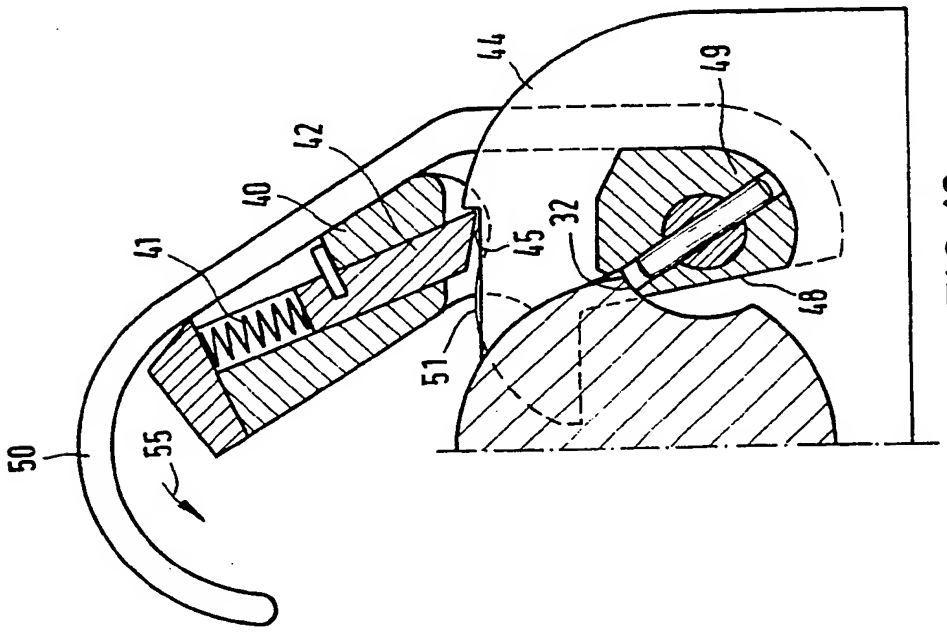

FIG.10

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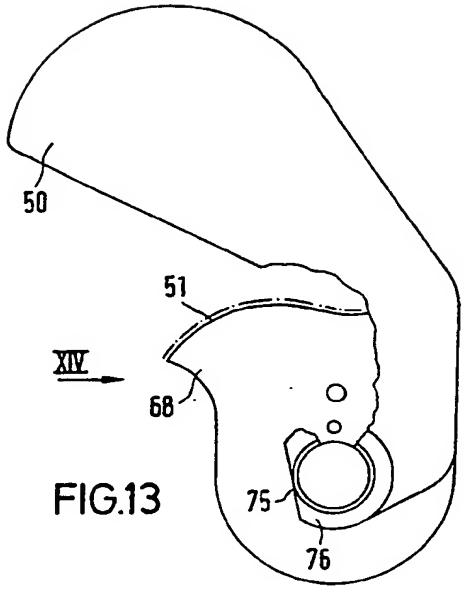

FIG.13

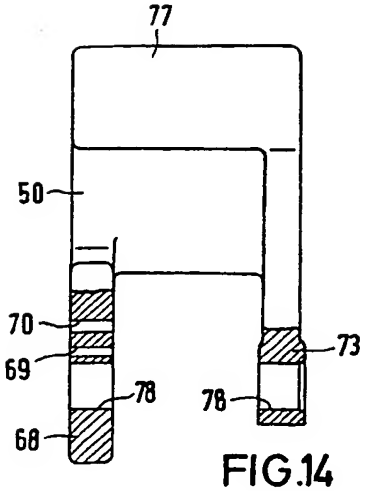

FIG.14

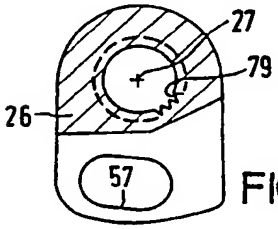

FIG.15

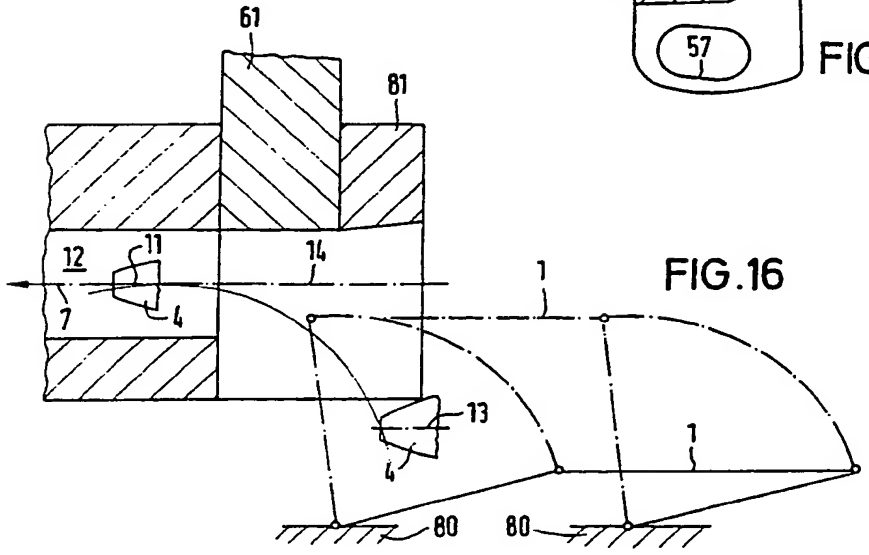

FIG.16

SPECIFICATION

Loading apparatus for a barrel weapon

The invention relates to a loading apparatus for a barrel weapon.

A loading apparatus is known from D.E. 25 01 425A, wherein the projectile is pivoted from stand-by position into a loading position. The loading apparatus has front and rear arcuate projectile holding clamps arranged symmetrically in pairs with each clamp being pivotable sideways, transverse to the longitudinal axis of the projectile. As a means of locking the projectile in position the clamps are in each case pivotable about a fulcrum on the rocking lever with different positions being obtainable by stops on a ratchet mechanism which are caused to follow up the movement by spring action. Under the force of the projectile inserted into the clamp each pivots out of a receiving position, allowing access from outside into a clamping position embracing the projectile symmetrically on both sides. From this position the loading apparatus pivots into the loading position with the pivoting movement taking place in a horizontal plane transverse to the direction of introduction of the projectile clamps.

With this arrangement it is not possible to effect a pivoting movement in the plane of the direction in which the projectile is introduced as the loading aperture is directly radially outwards and the centrifugal and braking forces on the projectile act radially outwards, thus making it impossible to be certain that the projectile clamps will not open automatically.

Furthermore, the projectile in the clamped position is surrounded and carried only by the clamps. To enable the loaded end position for the projectile to be reached the clamps have to be moved with the projectile in its axial direction.

It is an object of this invention, in contrast to the above, to provide for the closed position of the clamps of the loading apparatus to be secured in a simple and functionally reliable manner against forces acting opposite to the direction of introduction. Such forces particularly being the centrifugal force of the projectile in a pivoting plane through which the projectile is moved in a direction parallel to the barrel and from an introduction position into a loading position. The projectile being caused to assume the loading position without risk and to be moved axially on the loading apparatus into the loading chamber.

According to this invention there is provided loading apparatus for a barrel weapon the apparatus having two symmetrically opening and lockable projectile holding clamps, characterized by a loading device having clamps interconnected by a syncronous pivoting device arranged so that after the projectile has been positioned and one holding clamp closed the other clamp is automatically closed also, the closed position of the clamps being adjustable through a clamping jaw positioned between the clamp and the synchronous pivoting device which includes an adjusting means arranged so that the projectile is moved into the loading chamber in an axial direction after the position of insertion has been reached, the loading device on the side of the closing clamp having a locking device by which the clamps are both secured in the closed positions whereby the closed position is maintained when the projectile is subject to centrifugal force opposite to the introduction direction during the transfer of the projectile from an introduction position to the loading position.

The clamp preferably has only one clamp part closable the other being caused to accompany the closing movement by means of a synchronous pivoting device. The clamps preferably can only be locked in position when they have completely embraced the projectile. The clamps when in the closed position can be adjusted individually by a clamping jaw or adjusting device, in relation to the projectile, so that with a small clearance between the clamps and the projectile it is possible to slide the latter into the loading chamber.

It is also of advantage for the movement of the projectile from an introduction position into the loading position for the loading chamber to ensure that the closed position remains secured during the transfer of the projectile when centrifugal forces occur in opposition to the introduction position. Due to the synchronous movement device the method of locking the clamps in the closed position is simplified, in that one single locking device proves sufficient. The operation of locking the clamps can be carried out in a simple manner either by hand or automatically. Both versions ensure that the closed position of the clamps will not be released until a ratchet mechanism securing the clamps in the locked position is released or overcome by the opening of a lever. Owing to the fact that the clamps are either opened or only able to assume the secure closed position for transfer of a projectile, the situation in which the holding cheeks are only partly closed and could thus open during transport cannot occur, so that damage to the apparatus and injury to the personnel, in particular, are avoided.

A further advantage is that a pivoting lever of a clamp is so constructed that the locking operation is only possible on the closing of one particular holding cheek. Thus any tolerances and bearing clearances in the synchronous movement device have no effect and great accuracy can be obtained in setting the closed position and in the response of the locking device.

The invention is explained in more detail with reference to an embodiment shown as an example in the accompanying drawings, wherein:

Figure 1 shows a plan view of a loading clamp with manually lockable holding cheeks,

Figure 2 shows a cross section along the line II-II of Figure 1, showing the manual locking device and device for synchronous movement of the holding cheeks,

Figure 3 shows a view in direction III of a hand lever for the locking device,

Figure 4 shows a view to a larger scale, of the spring pressure bolt circled IV as shown in Figure 1,

Figure 5 shows a part-view in direction V of Figure 3, showing the securing groove of the spring pressure bolt shown in Figure 4.

Figure 6 shows a cross section of the surface on the line VI-VI of Figure 5,

Figure 7 shows a plan view of a loading clamp with automatically lockable holding cheeks,

Figure 8 shows a cross section on line VIII-VIII of Figure 7, showing the automatic locking device for the synchronous movement device for the holding cheeks,

Figure 9 shows a cross section on the line IX-IX of Figure 8, showing the mounting system for the locking device,

Figure 10 shows a simplified schematic cross section of the automatic locking device of Figure 8, in the locked and secured position,

Figure 11 shows the locking device of Figure 10 in the release phase,

Figure 12 shows the locking device of Figure 10 in the released and unlocked position,

Figure 13 shows the opening lever, looking in direction XIII of Figure 7,

Figure 14 shows a side view of the opening lever partly in section in direction XIV of Figure 13,

Figure 15 shows a front view of the operating lever referenced 26 in Figure 8,

Figure 16 shows a schematic diagram of the path taken in the operation of moving a clamp from the feed position for the projectile into the loading position in a loading chamber of a weapon.

Figures 1 and 2 as well as Figures 7 and 8 in each case show loading devices 1 for a large-calibre barrel weapon such as a tank gun. The loading apparatus has a housing 58 on which is rigidly mounted two support cheeks 2 which open and close symmetrically around the projectile 4. A device 3 for pivoting the clamps synchronously is provided with a locking device 8 to secure the holding clamps 2 in the locked position 5. The process of pivoting the loading apparatus 1 into the position 11 (Figure 16) for sliding the projectile into the loading chamber 12 (Figure 16) can be effected by an automatic system (not shown) or manually by means of a handle 60. In order to ensure that the projectile 4 can be pivoted as far as possible into the loading chamber 12 (Figure 16) without requiring undue space and in a manner which will not be impeded by the recoil of the barrel, the loading apparatus 1 is mounted parallel to the axis 14 of the barrel (Figure 16) on the side opposed to an opened locking wedge 61 (Figure 16). The centrifugal forces acting on the projectile during this pivoting process and in opposition to the introduction direction 9 are reliably absorbed by the clamps 2 and the locking device 8.

Because of the provision of the simultaneous pivoting device 3 it is sufficient for the clamps 2, when in the closed position 5, to be secured only on the side of the closing holding clamp 2.1. The holding clamp 2.1. of the locking device 8 can thus be easily operated from one side of the loading apparatus, and thus high degrees of accuracy in setting the closing position 5 in the response to the locking device 8 can be obtained without difficulty. It is only when the closed position 5 is reached that the clamps 2 are secured by a positive engagement of the locking device 8. In any other closing movement different from this the clamps 2 are automatically opened by restoring springs 20. For this reason one end 15 of the closing clamp 2.1 is connected with a lever 17 which can be pivoted with it and about the same axis 16 and in which the external profile 18 allows a securing lever 19 of the locking device 8 to engage to prevent the opening of the clamps 2 only when the closed position 5 has been reached.

The lever 17 advantageously comprises a circular disc 23 of which the peripheral surface 21 has a part circular shaped detent 22 engaged by the securing lever 19 and a through boring 24 offset from the axis 16 for coupling with a linkage forming a synchronous pivoting device 3. The securing lever 19 is pivoted about a further axis 43 and adapted in shape in the locking zone to the disc 23 so that it is only in the closed position 5 that a cylinder 49 having a curvature corresponding to the curvature of the detent 22 can enter same. When the clamps 2 are open the securing lever 19 bears on the peripheral surface 21 of the disc 23 with a segmental surface 48 of the cylinder 49 lying parallel to the axis 43. The lever can slide in the opening and closing process so that when the clamps 2 are open the securing lever 19 cannot then effect any locking action.

In order to obtain a closing pivoting movement of the clamp about the axis 27 this clamp is coupled to a lever 26 which is pivotable about the axis 27 and which has a bearing 62 eccentrically located relative to the axis 27 and serving to receive the linkage 3 comprising a push/pull rod 25. The pivoting movement of the two clamps occurs on the closure of the clamp 2.1 because the other

end of the device 3 located in the bore 14 of the disc 23 is positioned above the axis 16 while the end of device 3 which is carried by the lever 26 is positioned below the axis 27. On the opening of the clamps 2.1 and 2.2 the device 3 moves in the direction of arrow 28. The push/pull rod 25 consists of two individual rods 25.1 and 25.2, one end of the rod 25.1 being affixed in bearing 62 and one end of the rod 25.2 in the bore 24, the free ends being interconnected by a screw adjusting device 10. This enables the closed position 5 and the closing movement of the clamp 2.1 accompanying the closing movement about the axis 27 to be selected accurately and uniformly. The closing movement 5 of the clamp 2.1 can be set in accordance with the calibre. For this purpose a stub shaft 29 of the clamp 2.1 and a stub shaft 30 of the disc 23 are connected by an adjustable clamping jaw 6. The adjustability through the clamping jaw 6 and the adjusting device 10 enables the closing position 5 to be selected with only a small clearance so that it is possible to move the projectile 4 into the loading chamber 12 (Figure 16) in an axial direction.

Figures 1 and 2 show how the locking position 32 is assumed in the detent 22 of the disc 23 by a manually operable hand lever 31 of the locking device 8, in which method in order to hold the locked position 32 a spring bolt 33 (Figure 4) guided in a housing 66 (Figure 4) secured to the loading apparatus engages a securing groove 34 (Figure 4) in the lever 31.

Figure 3 shows in detail the hand lever 31 which is pivotable by a handle 63 about the axis 43 of the bore 64 and wherein the arm 65 contains the securing groove 34 (Figure 4).

In order to ensure the necessary holding force for the hand lever 31 in the locked position 32 the spring force of the spring bolt 33 shown in Figure 4 is adjustable by means of nut 36 situated inside the housing 66.

As shown in Figures 5 and 6 the securing groove 34 is formed as a taper notch 37 extending radially with respect to the axis 43. On the hand lever 31 is a sliding track 39 positioned in front of the taper notch 37 and extending from the latter in a curved or a slanting course, so that an edge 38 is formed and this, in conjunction with the rounded nose 35 of the spring pressure bolt 33, prevents the hand lever 37 from assuming an unstable state when the disc 23 is secured. If the spring pressure bolt 33 has not engaged the notch 37 then the bolt, by spring force, presses the hand lever 31 on the sliding track 39 back into the open position, so that a partly locked state of the locking position 32 cannot occur. The holding clamps 2 in this process deviate from the closed position 5 and automatically pivot back into the open position.

In figures 7 and 8 the locking device 8 has a securing lever 19 constructed as a self-locking lever 40 for the locking position 32 and this, when the clamp 2 occupies the closed position 5, provides automatic and reliable engagement into the recess 22 of the disc 23 without manual operation.

To secure the locking position 32 a pawl 42 is provided inside the lever 40 and this can engage, through force of spring 41, a detent 45 (Figure 10) in the housing wall 44 of the loading apparatus 1. The shaft 46 carries a further separately pivotable opening lever 50, which surrounds the lever 40 on one side and contains a lifting cam 59 (Figure 10) whereby the movement of the opening lever 50 in the opening direction 52 (Figure 11) causes the pawl 42 to be lifted out of the position in which it engages the recess 45 (Figure 10). When the closed position 5 of the clamps 2 is reached the opening lever 50 is moved along with lever 40 into the locked position 32, but to release the pawl 42 it is pivoted back manually into the opening position 52 (Figure 11) independently of the lever 40. In this process, after the pawl 42 has been released, the lever 40 automatically returns from the locking position 32.

This method of operation necessitates two restoring elements operating independently of each other and connected to the opening lever 50. These elements comprise torsion springs 47 and 53 in Figure 9. The torsion spring 47 is positively connected by its free end to the shaft rotatable about the axis 43, the shaft 46 being likewise positively connected with the lever 40, for example, by means of pins 67. The free end of the torsion spring 53 is not supported against the locking device 8 (Figure 7) but against the loading apparatus 1 (Figure 7) for example in a groove 54 of the stub shaft 30 (Figure 7). The torsion spring 47 is connected via a boring 69 (Figure 14) and the torsion spring 53 via a boring 70 with an arm 63 of the opening lever 50 (Figure 14) and containing a control cam 51 (Figure 13). The torsion spring 47 is enclosed by the torsion spring 53 to save space and the springs are mutually supported and centred by means of bush 71 and secured on the outside by a housing 72 which can be screwed on to the shaft 46.

The shaft 46 is mounted in the housing wall 44 which has the recess 45 (Figure 10) and in the housing wall 74 of the loading device 1 (Figure 8). Between the housing wall 44 and 74 is a further arm 73 and the opening lever 50 (Figure 14) as well as lever 40. In a zone facing away from the shaft 46 (not shown) for receiving the pawl 42 (Figure 8) and which on one hand must engage the housing wall 44 and on the other hand must be lifted from the cam 51 (Figure 13) of the lever arms 68 the lever 40 is bent to one

side.

The mount of the arm 73 has a cylinder 76 (Figure 13) and a segmental surface 75 (Figure 13), which is bevelled as the cylindrical zone of the lever 40 (Figure 8). The arm 73 can thus support the locking position 32 (Figure 8) together with the lever 40 in relation to the disc 23.

The method of operation of the automatic locking system is described in more detail with reference to Figures 9 to 14. In Figure 10 the lever 40 and the adjacent opening lever 50 are in the locking position 32. The torsion spring 47 is expanded while the torsion spring 53 exerts a restoring force in the direction of rotation 55. The cylinder 49 of the lever 40 which has the segmental surface 48 is secured in the recess 22 by pawl 42 which engages the recess 45 under the force of spring 41.

Figure 11 shown the situation immediately before release of the locking position 32. With the opening lever 50 almost opened, although the lever 40 is still secured in the recess 45, the torsion spring 47 is prestressed by the opening lever 50 in the direction 52, in such a way that the lever 40, after the pawl 42 has disengaged from the recess 45, automatically moves in the direction 52 to overcome the locking position 32.

When the opening lever 50 is fully opened in the direction 52 and the lever 40 is pivoted back in the said direction 52, as shown in Figure 12, the disc 23 is released so that by the contour 18 it is pivoted back along the stationary segmental surface 48 to assume the released position 56. In this position 56 the holding clamps 2 (Figure 8) are fully opened. With the lever 50 opened the torsion spring 53 is prestressed to a maximum so that after closing of the holding cheek 2.1 (Figure 8) and the pivoting of the disc 23 from the released position 56 into the locked position 32 (Figure 10) the lever 40 can be pivoted back by entrainment of the opening lever 50 in the direction of rotation 55 in order to lock the cylinder 49 which is shaped to engage disc 23. The pawl 42 under the force of spring 41 can be automatically caused to engage with the recess 42.

Figures 13 and 14 show the opening lever 50 provided with a handle 77 by which the aforementioned arms 68 and 73 are interconnected. To enable the pivoting movement to be effected about the shaft 46 (Figure 9) each of the arms 68 and 73 has a bore 78.

To enable the clamps 2 (Figures 2 and 8) to be locked so as to set the locking position 5 (Figures 2 and 8) with a high degree of accuracy and to enable the locking device 8 to respond accurately thus avoiding tolerance and bearing clearances when only one clamp (2.1) is closed manually the lever 26 of the clamp 2.2 (Figures 2 and 8) accompanying the pivoting movement is provided with a slot 57 (Figure 15) positioned eccentrically with respect to the axis 27 and serving to receive the rod 25 (Figures 2 and 8). This ensures that if the clamp 2.2 is closed accidentally the rod 25 is not caused to accompany the movement in the pivoting range of the slot 57. Thus when the clamp 2.2 occupies the closed position (Figures 2 and 8) no locking operation is effected. Owing to the fact that the clamps 2 (Figures 2 and 8) can only be locked and secured in an automatic sequence following the closure of the clamp 2.1 (Figures 2 and 8) the resulting single direction of force is free from tolerances and bearing clearances, a high degree of accuracy being achieved in the selection of the locked position 5 and also in the response of the locking device 8 when engaging the locking position 32. The means of transmitting the pivoting movement to the clamps 2 may comprise a system of teeth 79 situated concentrically about the axis 27 and being likewise concentric with the axis 16 (Figures 2 and 8) in the disc 23 (Figures 2 and 8) and on the stub shaft 30.

Figure 16 shows schematically the method of pivoting the loading apparatus 1 which carries the projectile 4 from the standby position 13 into the loading position 11 in the loading chamber 12. The loading apparatus 1 is secured parallel to the axis 14 of the weapon and is pivotable on the housing 80 of the weapon in such a way that in the position 13 it does not obstruct the breech 82 moving back after firing. The apparatus can be pivoted into the loading chamber 12 to a sufficient extent without taking up excess space when the breech again moves forward. The loading apparatus moves with the elevation setting of the gun. In Figure 16 the axis 14 is horizontal and is adjustable in elevation over a pivoting range of between -7 and $+70°$, so that the projectile 4 can be safely loaded at different barrel elevations.

CLAIMS

1. Loading apparatus for a barrel weapon, the apparatus having two symmetrically opening and lockable projectile holding clamps characterized by a loading device having clamps interconnected by a synchronous pivoting device arranged so that after the projectile has been positioned and one holding clamp closed, the other clamp is automatically closed also, the closed position of the clamps being adjustable through a clamping jaw positioned between the clamp and the synchronous pivoting device which includes an adjusting means arranged so that the projectile is moved into the loading chamber in an axial direction after the position of insertion has been reached, the loading device on the side of the closing clamp having a locking device by which the clamps are both secured in the closed positions whereby the closed

position is maintained when the projectile is subject to centrifugal force opposite to the introduction direction during the transfer of the projectile from an introduction position to the loading position.

2. Loading apparatus in accordance with Claim 1, wherein one end of the closing clamp is connected with a lever pivotable about a common axis with the clamp the profile of the lever being such that in the closed position a securing lever of the locking device positively engages the lever, the opening of the clamps assisted by restoring spring means thus being prevented.

3. Loading apparatus in accordance with Claim 2, wherein the lever pivotable about the clamp axis comprises a disc of which the peripheral surface has a circular detent engaged by the securing lever, the disc having a boring positioned eccentrically to the axis forming a coupling for the synchronous pivoting device.

4. Loading apparatus in accordance with Claim 3, wherein the securing lever is pivotable about a further axis and adapted in shape in the locking zone to the shape of the disc so that in the closed position a cylindrical surface conforming to the radius of curvature of the detent is engaged in the detent, when the clamps are open the securing lever, together with a segemental surface of the cylinder, bearing on the peripheral surface of the disc.

5. Loading apparatus in accordance with Claim 4, wherein the synchronous pivoting device is constructed as a push/pull rod which, in order to produce a closing pivoting movement of the clamp, accompanying the pivoting movement about the axis, is eccentrically coupled with a lever pivotable together with the clamp about the axis, the ends of the rod in the open position and closed position taking up with the disc a position above the axis thereof and with the lever in a position below the axis thereof.

6. Loading apparatus in accordance with Claim 5, wherein the clamping jaw embraces a stub shaft of the closing clamp and a stub shaft of the disc in order to set the particular closed position in which the clamp can be secured.

7. Loading apparatus in accordance with Claim 6 wherein the push/pull rod comprises two individual rods interconnected by an adjusting device to afford a means of setting the closed position for the clamp which accompanies the closing movement.

8. Loading apparatus in accordance with Claim 7, wherein the locking device includes a securing lever which, to enable it to assume the locked position in the recess of the disc, is constructed as a manually operable hand lever.

9. Loading apparatus in accordance with Claim 8, wherein the hand lever contains a securing groove which, in order to secure it in the locked position, which has been taken up, receives a spring bolt mounted in a housing on the loading apparatus.

10. Loading apparatus in accordance with Claim 9, wherein the spring force of the spring bolt can be set by means of an adjusting nut to the holding force required to secure the hand lever in the locked position.

11. Loading apparatus in accordance with Claim 10, wherein the securing groove is in the form of a tapering notch and the hand lever has a sliding track for the spring bolt and positioned in front and extending down from the tapering notch whereby an edge is produced to provide a means of preventing the hand lever from assuming an unstable state when the disc is secured in position, the hand lever being automatically pivoted back from the locked position when the spring bolt acts on the sliding path.

12. Loading apparatus in accordance with Claim 11, wherein the locking device includes a securing lever which is constructed as a self-locking lever for the locked position and which, when the clamps occupy the locked position, is automatically and without manual operation engaged and secured in the detent of the disc.

13. Loading apparatus in accordance with Claim 12, characterized by:

a) the lever (40) is positively connected with shaft (46) rotatable about axis (43),

b) the lever (40) has a spring-actuated and slidably guided pawl (42) serving to secure the locked position (32)

c) the wall (44) of the housing of the loading apparatus (1) has a recess (45) forming an attachment, in which the pawl (42) is engaged when the lever (40) occupies the locked position (32)

d) the shaft (46) carries a further, separately pivotable opening lever (50) which embraces the lever (40) on one side and which contains a lifting cam (59) by which, during the movement of the opening lever (50) in the opening direction (52), the pawl (42) is lifted out of the position in which it engages the recess (45),

e) two independent torsion springs (47,53) acting as restoring elements are connected with the opening lever, the torsion spring (47) being positively connected to the shaft (46), the torsion spring (53) being supported in a groove (54) of the shaft stub (30),

f) in the locked position (32) with the opening lever (50) resting against the lever (40) the torsion spring (47) is expanded while the torsion spring (53) exerts a restoring torque in the direction of rotation (55),

g) when the opening lever (50) is nearly open and the lever (40) still engaged in the recess (45) the torsion spring (47) is prestressed in such a way that the lever (40), when the pawl (42) disengages from the recess (45), automatically moves in the direc-

tion (52) so that the locked position (32) can be overcome,

h) when the opening lever (50) is fully opened in the direction (42) the torsion spring (53) is prestressed to the maximum whereby after the clamp (2.1) has closed and the disc 23 pivoted from the released position (56) into the locked position (32) then the lever (40) can be pivoted back by holding the opening lever (50) in the direction of rotation (55), to lock the cylinder (49) which is designed to engage the disc (23) and pawl (42) under the pressure of the spring (41), same can be automatically caused to engage the detent (42).

14. Loading apparatus in accordance with Claim 5 to 13, wherein the lever (26) of the clamp (2.2) which accompanies the pivoting movement includes a slot (57) eccentric with respect to the axis (27) and serving to accomodate the push/pull rod (25) so that when the clamp is closed manually the rod (25) is not caught in the pivoting range of the slot (57), a locking action not being possible when the clamp occupies the closed position (5), so that the clamp can only be locked and secured in an automatic sequence by closing the clamp.

15. Loading apparatus constructed and arranged to function as described herein and exemplified in the accompanying drawings.

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